Small Business Innovation Research/Small Business Tech Transfer

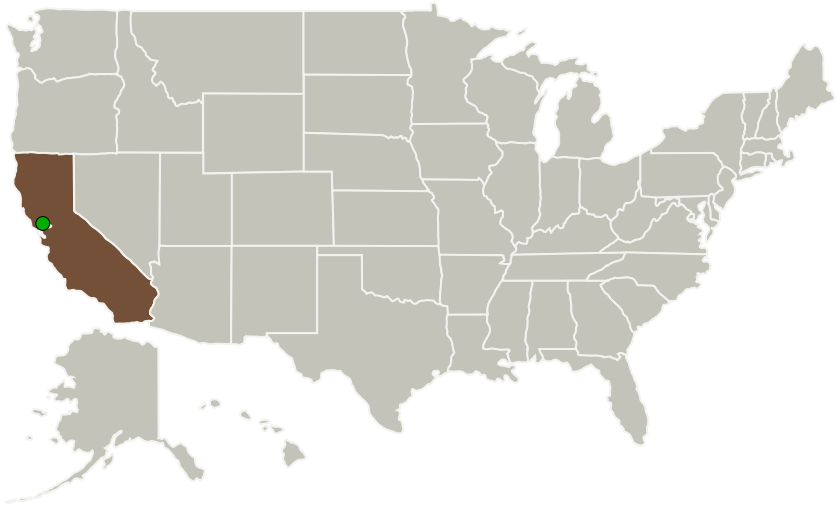
Increasingly Autonomous Traffic Flow Management Under Uncertainty, Phase I

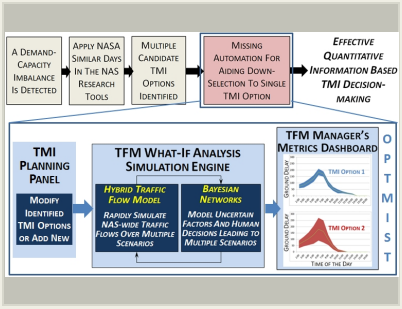
Completed Technology Project (2016 - 2016)

Project Introduction

Today, traffic managers largely rely on their intuition for making Traffic Management Initiative (TMI) decisions due to lack of decision aids. As a result TMIs are often inefficient and there is a lot of variability in their application across similar situations. NASA's 'Similar Days in the National Airspace System (NAS)' research addresses this issue, but, the research tools produce not a single recommended TMI choice but an array of choices, with the final decision again left to the manager's intuition. The proposed SBIR research provides a capability for down-selecting to the most effective TMI choice by developing a what-if analysis functionality for exploring multiple TMI options by realistically simulating NAS-wide operations under the influence of individual TMI options. This what-if analysis capability achieves accurate modeling of NAS traffic flows under uncertainty by creatively integrating two innovations. The first is a traffic flow modeling framework for enabling fast and accurate simulation of individual aircraft transits through the NAS network. This traffic flow modeling framework, which we call the Hybrid Traffic Flow model combines desirable features of trajectory-based models with aggregate traffic flow models to allow fast, near real-time NAS performance evaluation under multiple candidate TMI options. Each option is evaluated under multiple scenarios to capture the whole range of possibilities as per the underlying real world uncertainties,. The second is Bayesian Networks for modeling variations caused by underlying NAS uncertainty factors with explicit encoding of human reasoning behind multiple influencing decisions (e.g., Center MIT restriction impositions, airline cancellations), this enables realistic traffic demand and capacity forecasting for feeding the traffic flow model-based TFM evaluations.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
ATAC	Lead Organization	Industry	Santa Clara, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

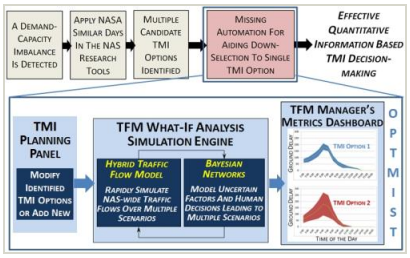
June 2016: Project Start

December 2016: Closed out

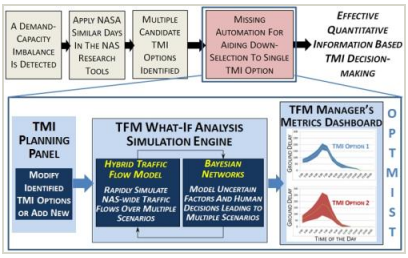
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139613)*

Images



Briefing Chart Image
Increasingly Autonomous Traffic Flow Management Under Uncertainty, Phase I
(https://techport.nasa.gov/image/128723)



Final Summary Chart Image
Increasingly Autonomous Traffic Flow Management Under Uncertainty, Phase I Project Image
(https://techport.nasa.gov/image/129486)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
ATAC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

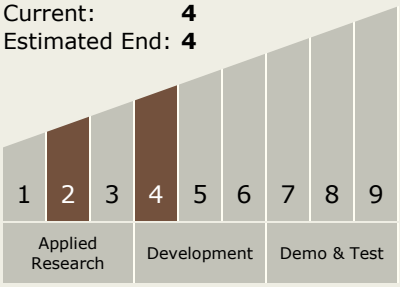
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Aditya Saraf

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.1 Aerodynamics

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System